REMARKS

Applicants appreciate the indication in the Office Action that claims 1-65, 67-87 and 90-125 are allowed. The applicants have the following comments on the reasons for allowance set forth in the Office Action.

In the Office Action, claim 29 is allowed on the ground that "the prior art of record, taken alone or in combination, fails to disclose or render obvious a sample measurement system that includes the combination of a fixed or rotating polarizing element, prior to the sample, a second rotating polarizing element and a fixed linear polarizer after the sample, in combination with the rest of the limitations of claims." Applicants believe that the above reason for allowance implies unnecessary limitations in claim 29. The method of claim 29 includes "providing a beam of polarized radiation having a linearly polarized component and supplying radiation from the beam to the sample," which may be provided in a number of different ways using or without using a fixed or rotating polarizing element prior to the sample. The method of claim 29 also includes "modulating radiation from the beam before modification by the sample by means of a rotating polarizing element" and "passing the modulated radiation through a fixed or rotating linear polarizer prior to its detection." Thus, the method of claim 29 is not limited to the use of both a second rotating polarizing element and a fixed linear polarizer after the sample.

Claim 70 has been allowed in the Office Action on the ground that "the prior art of record, taken alone or in combination, fails to disclose or render obvious a sample measurement system that includes the provision of linearly polarized light to a sample and a rotating phase modulator and a rotating polarizer to derive ellipsometric parameters of the sample and parameters of the source, optics or modulator, in combination with the rest of the limitations of claims." Applicants also believe that such reason of allowance implies

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unnecessary limitations in claim 70. Specifically, claim 70 does not include a rotating phase modulator. Claim 70 includes "a system deriving one or more ellipsometric parameters of the sample from the detected radiation" but does not include the limitation of deriving parameters of the source, optics or modulator, or necessarily more than one ellipsometric parameters of the sample. As to claim 37, Applicants wish to clarify that the "system" of claim 37 derives "one or more parameters of the source, optics or modulating device ..." and not necessarily more than one ellipsometric parameter of the sample.

Claims 88 and 89 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 4,893,932 to Knollenberg. The rejection is traversed insofar as it applied to the claims as amended. Thus, as amended, claim 88 includes the limitation of a system deriving one or more ellipsometric parameters of the sample from the detected radiation. Knollenberg is directed to an optical system for detecting particles on or below a surface of material. Even though Knollenberg mentions the determining of defects on or below the sample surface, Knollenberg has failed to describe a system for determination of defects on or below the sample surface where the defect is anything other than a particle.

Knollenberg fails to teach or suggest a system deriving one or more ellipsometric parameters of the sample from the detected radiation. It is believed to be well settled that for a reference to anticipate a claim, there must be identity of elements between the elements of the rejected claims and those of the reference. Since Knollenberg fails to teach or suggest at least one element of claim 188, Knollenberg fails to anticipate claim 88.

The system of Knollenberg is based on the theory that when a light beam is used to illuminate a sample at oblique incidence, a P-polarized beam would scatter more than a S-polarized beam for very small particles, and that the amplitude of any reflected wave illuminating the particle is a function of the state of polarization of the illumination beam and

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the optical properties of the surface. For this purpose, Knollenberg proposes to illuminate the surface of a sample by means of an oblique P-polarized beam and an oblique S-polarized beam and detecting the amplitudes of the scattered light intensities for detecting particles on or below the surface of the sample. In view of Knollenberg's purpose, there is no reason or motivation to modify Knollenberg's system so as to detect one or more ellipsometric parameters of the sample. Therefore, it is believed that claim 88 is also non-obvious over Knollenberg and is therefore allowable.

Claims 126-143 have been added to more adequately cover the invention. The claims added are also believed to be patentable over Knollenberg. Thus, claim 130 is directed to an apparatus for measuring a surface of a sample that includes a system providing one or more characteristics of the sample surface from the detected radiation. Such sample characteristics are characteristics inherent in the sample surface and do not depend on foreign matter or impurities on the sample surface. Such characteristics include film thickness, refractive index and/or sample roughness. See page 5, lines 14-15 and page 38, lines12-13, for example. Since Knollenberg is interested only in the detection of particle contamination on or below a surface of material, Knollenberg fails to teach or suggest measuring such surface characteristics of samples so that claim 130 is also believed to be allowable over Knollenberg. For substantially the same reasons as those explained above for claim 130, claims 136 and 140 are likewise believed to be allowable.

Claims 89, 131-135, 137-139 and 141-143 are also believed to be allowable since they add limitations which are not taught or suggested by Knollenberg. Thus, claims 128, 132 and 139 and 142 add the limitation of the specific types of surface characteristics that are derived; clearly these are not taught or suggested by Knollenberg. Claims 89, 135 and 143 add the limitation that the cylindrical objective is such that radiation from the beam is focused to a

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substantially circular spot on the sample. This is clearly not taught or suggested by Knollenberg. As a matter of fact, in semiconductor wafer inspection, in order to increase through put, the illuminated spot on the surface of the wafer in defect detection systems are often purposely designed to be elliptical in shape to cover a wider area swept by the spot in scanning the wafer surface. See for example, U.S. Patent 5,883,710. Since Knollenberg has failed to teach or suggest the focusing of the illumination beam to a circular spot, Knollenberg has failed to teach or suggest such feature.

Allowed claims 17, 23, 25, 27 have also been amended to eliminate a claim limitation; these claims are therefore NOT amended for reasons related to their patentability.

Claims 1-65, 67-82, and 88-143 are presently pending in the application. Reconsideration of the reasons for allowance and the rejection is respectfully requested and an early indication of the allowability of all the claims is earnestly solicited.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on April 15, 2003.

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4/15/03
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

17. (Amended) A method for measuring a sample, comprising:

~~providing a beam of radiation;~~

passing ~~the~~a -beam of radiation through a first fixed or rotating polarizing element so that a polarized radiation from the beam is supplied to the sample;

modulating radiation from the beam after modification by the sample by means of a second rotating polarizing element to provide a modulated beam;

detecting radiation from the modulated beam;

polarizing the modulated beam before radiation from the modulated beam is detected by means of a fixed linear polarizer; and

deriving one or more ellipsometric parameters of the sample from the detected radiation.

23. (Amended) The method of claim 17, wherein said passing ~~providing~~ step comprises passing unpolarized radiation through a fixed linear polarizer.

25. (Amended) The method of claim 17, wherein said passing ~~providing~~ step ~~provides~~ passes a beam of broadband radiation.

27. (Amended) The method of claim 17, said deriving step comprising deriving one or more parameters of the two elements, or of a system used in the ~~providing~~passing, detecting or modulating step.

88. (Amended) An apparatus for measuring a sample, comprising:

a source providing a beam of radiation;

optics comprising a cylindrical objective for focusing radiation from the beam to the sample in a direction away from a normal direction to the sample;

a detector detecting radiation from the beam that has been modified by the sample;

a modulating device modulating the beam of radiation prior to its detection; and

a system deriving ~~a reflectance or~~ one or more ellipsometric parameters of the sample from the detected radiation.

89. (Amended) The apparatus of claim 88, said cylindrical objective being such that radiation from the beam is focused to a substantially circular spot on the sample.

117. (Amended) The apparatus of claim 114, wherein said ~~deriving means~~system derives parameters related to the ellipsometer.

118. (Amended) The apparatus of claim 117, said first output signals indicating sample characteristics over a spectrum of wavelengths, wherein said ~~deriving means~~system derives depolarization of radiation caused by the sample over the spectrum.

122. (Amended) The apparatus of claim 119, said first output signals indicating sample characteristics over a spectrum of wavelengths, wherein said ~~deriving means~~system derives depolarization of radiation caused by the sample over the spectrum.

126. (New) The apparatus of claim 88, wherein the objective comprises a lens or mirror.

127. (New) The apparatus of claim 88, wherein the objective has focusing power in a plane of incidence of the beam.

128. (New) The apparatus of claim 88, wherein the system derives, from the one or more ellipsometric parameters of the sample, one or more surface characteristics of the sample.

129. (New) The apparatus of claim 128, wherein the one or more surface characteristics of the sample comprise(s) film thickness, refractive index and/or surface roughness.

130. (New) An apparatus for measuring a surface of a sample, comprising:

a source providing a beam of radiation;

optics comprising a cylindrical objective for focusing radiation from the beam to the sample in a direction away from a normal direction to the sample;

a detector detecting radiation from the beam that has been modified by the sample;

a modulating device modulating the beam of radiation prior to its detection; and

a system providing one or more characteristics of the sample surface from the detected radiation.

131. (New) The apparatus of claim 130, wherein the system derives a reflectance or one or more ellipsometric parameters of the sample from the detected radiation, and provides the one or more characteristics from the derived reflectance or one or more ellipsometric parameters of the sample.

132. (New) The apparatus of claim 130, wherein the one or more characteristics comprise(s) film thickness, refractive index and/or surface roughness.

133. (New) The apparatus of claim 130, wherein the objective comprises a lens or mirror.

134. (New) The apparatus of claim 130, wherein the objective has focusing power in a plane of incidence of the beam.

135. (New) The apparatus of claim 130, said cylindrical objective being such that radiation from the beam is focused to a substantially circular spot on the sample.

136. (New) A method for measuring a sample, comprising:

focusing a radiation beam to the sample in a direction away from a normal direction to the sample by means of optics comprising a cylindrical objective;

detecting radiation from the beam that has been modified by the sample;

modulating radiation from the beam prior to its detection; and

deriving one or more ellipsometric parameters of the sample from the detected radiation.

137. (New) The method of claim 136, wherein focusing focuses to a substantially circular spot on the sample.

138. (New) The method of claim 136, wherein the deriving derives, from the one or more ellipsometric parameters of the sample, one or more surface characteristics of the sample.

139. (New) The method of claim 138, wherein the one or more surface characteristics of the sample comprise(s) film thickness, refractive index and/or surface roughness.

140. (New) A method for measuring a surface of a sample, comprising:

focusing a radiation beam to the sample in a direction away from a normal direction to the sample by means of optics comprising a cylindrical objective;

detecting radiation from the beam that has been modified by the sample;

modulating radiation from the beam prior to its detection; and

providing one or more characteristics of the sample surface from the detected radiation.

141. (New) The method of claim 140, wherein the providing derives a reflectance or one or more ellipsometric parameters of the sample from the detected radiation, and provides the one or more characteristics from the derived reflectance or one or more ellipsometric parameters of the sample.

142. (New) The method of claim 140, wherein the one or more characteristics comprise(s) film thickness, refractive index and/or surface roughness.

143. (New) The method of claim 140, said cylindrical objective being such that radiation from the beam is focused to a substantially circular spot on the sample.